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44TH CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 172.

LINES OF COMMUNICATION BETWEEN SOUTHERN COLORADO AND NORTHERN NEW MEXICO.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of Lieutenant Ruffner relative to lines of communication between Southern Colorado and Northern New Mexico.

MARCH 31, 1876.—Referred to the Committee on Military Affairs.
JUNE 8, 1876.—Ordered to be printed and recommitted to the Committee on Military Affairs.

WAR DEPARTMENT, *March* 29, 1876.

The Secretary of War has the honor to transmit to the House of Representatives, in compliance with the resolution of the House dated the 15th instant, copy of the report of Lieutenant Ruffner and accompanying papers, relative to lines of communication between Southern Colorado and Northern New Mexico.

ALPHONSO TAFT,
Secretary of War.

WAR DEPARTMENT,
Washington City, April 6, 1876.

SIR: The report of Lieut. E. H. Ruffner, Corps of Engineers, has been sent to the House of Representatives and should be printed. The maps accompanying the report should be photolithographed.

Very respectfully,

H. T. CROSBY,
Chief Clerk.

Hon. S. B. ELKINS,
House of Representatives.

HEADQUARTERS DEPARTMENT OF THE MISSOURI,
OFFICE OF THE CHIEF ENGINEER,
Fort Leavenworth, Kans., January 28, 1876.

SIR: I have the honor to submit herewith a report on the lines of communication between Northern New Mexico and Southern Colorado, and

include therein a report on a "survey for a direct wagon-road from Fort Garland, Colo., to Fort Wingate, N. Mex.," made by Lieut. G. S. Anderson, Sixth Cavalry, under my directions in 1874. These reports, made in obedience to verbal instructions of the department commander, have been so long delayed because of inability on my part to have the drawings completed, owing to lack of funds for payment of the services of a draughtsman. The map contains so much new matter, and the relations of sections of the country in question to each other have changed so much in late years, that I hardly felt justified in making a report, which would be unintelligible without proper maps. I hope, as it is, that if my views meet the approval of the department commander there will be ample time to forward this report for the consideration of the desired appropriation. I venture to suggest that, as the roads reported on if completed would be immediately used as much for civil as military purposes, and because their very construction would, by the additional protection afforded the civil interest, invite a travel now unknown over the lines in question, it would be eminently proper that the items be inserted in the appropriation bill for "sundry civil expenses of the Government."

I hope this report may be printed; and I believe that the first or general map may be of sufficient value to warrant its reproduction by photo-lithography.

I am, sir, very respectfully, your obedient servant,

E. H. RUFFNER,
First Lieutenant Engineers.

ASSISTANT ADJUTANT-GENERAL,
Department of the Missouri.

[First indorsement.]

HEADQUARTERS DEPARTMENT OF THE MISSOURI,
Fort Leavenworth, Kans., January 31, 1876.

This report is respectfully forwarded. It is complete and needs no explanation. I desire to say, however, that every day makes more necessary better wagon communication between Southern Colorado, and especially between the railroad termini, and the valley of the Rio Grande. This work is needed very much for military but far more for commercial purposes. The routes described in this report, and carefully delineated on the maps, lead from Pueblo (the terminus of the Denver and Rio Grande Narrow-Gauge Road) and from Las Animas, the junction of the Kansas Pacific and Atchison, Topeka and Santa Fé roads, to a common point, (the Abeda Pass,) which traverses the lofty range of mountains separating the valley of the Rio Grande from the great plains east of the Rocky Mountains.

The route thence descends into the valley of the Rio Grande at a point near Fort Garland, and thence following substantially the valley of the river conducts to Santa Fé, N. Mex., at which point roads diverge in every direction to the main body of settlements and towns in New Mexico. Near Santa Fé terminates substantially at the north, the wide valley of the Rio Grande, which, to a distance of three hundred miles south, is almost a continuous succession of towns, villages, and farms, and in that distance embraces three-fourths of the population, and a larger proportion of the wealth of the Territory.

A considerable sum has already been expended, and well spent, too, in improving the road from Santa Fé to a point near Taos, and a very fine road has been completed nearly the whole distance. There still remains an interval of about twenty-five miles where work is needed, and

for this work an appropriation of $10,000 is needed and asked. With a judicious expenditure of this amount, certain to be made by Lieutenant Ruffner, engineer, who has made that portion of the road now complete, it is certain that the best, shortest, and most available route in every respect will be established with New Mexico. The advantages of this route, and the distance saved, are fully set forth in the inclosed report and maps, and the subject is of so much importance, not only to the military service, but to every commercial and political interest in New Mexico, that I urge, as strongly as is proper, that an appropriation be asked and pressed in the manner suggested by Lieutenant Ruffner.

The appropriation asked for a wagon-road from Fort Garland to Fort Wingate would be of great advantage to the military force, and of indirect advantage in opening better communication with Arizona, but I consider the completion of the wagon-road from Santa Fé up the valley of the Rio Grande, and thence to the railroad termini of such consequence, both to the military and commercial interests of Colorado and New Mexico, that I venture to urge it with unusual earnestness.

The old route, and that mainly in use now because of local difficulties on that for which an appropriation is asked, is much longer and less advantageous in every respect, and conducts through the same range of mountains after a long detour. The necessity of free and better communication has outgrown the old route, and unless the road along the Rio Grande, needing so small an amount, is completed, the difficulties and embarrassments will every day increase.

JNO. POPE,
Brevet Major-General, Commanding.

[Second indorsement.]

HEADQUARTERS MILITARY DIVISION MISSOURI,
Chicago, February 7, 1876.

Respectfully forwarded to the Adjutant-General of the Army. I indorse the recommendation of Brigadier-General Pope for an appropriation of $10,000 for the completion of the wagon-road from Fort Garland to Santa Fé, by way of Taos, on the east side of the Rio Grande River; but I am not prepared at this time to recommend an appropriation for the construction of a wagon-road from a point near Fort Garland to Fort Wingate, over the short route by Tierra Amarilla, surveyed and reported upon by Lieutenant Ruffner.

P. H. SHERIDAN,
Lieutenant-General, Commanding.

[Third indorsement.]

WAR DEPARTMENT,
ADJUTANT-GENERAL'S OFFICE,
Washington, February 11, 1876.

Respectfully referred to the Chief of Engineers.

E. D. TOWNSEND,
Adjutant-General.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
Washington, February 18, 1876.

The information contained in the accompanying papers and maps has been noted in this Office, and they are respectfully returned to the

Adjutant-General. The importance of completing the military wagon-road on the east side of the Rio Grande between Fort Garland and Santa Fé is fully set forth in Lieutenant Ruffner's report and the preceding indorsements. The sum of $31,444.80 has been appropriated for this road by acts of March 3, 1873, and March 3, 1875. Lieutenant Ruffner estimates that the sum of $10,000 is required to make it available for Government transportation, which upon its completion would avoid the long detour via Trinidad, Cimarron, and Fort Union. Respecting the proposed military wagon-road from Fort Garland, Colo., to Fort Wingate, N. M., via the Tierra Amarilla and the western flanks of the Gallinas and Jemez Mountains, the attention of the honorable the Secretary of War is respectfully invited to Lieutenant Ruffner's tables showing the savings in distance which it would effect between Fort Wingate and the present and prospective termini of the railways from the East. The amount of Government transportation to Fort Wingate, not including Indian supplies, he estimates at about 475 tons annually, and its annual cost as $7,500 per one hundred miles.

By direction of Brigadier-General Humphreys, and in his absence.

GEORGE H. ELLIOT,
Major of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT,
ADJUTANT-GENERAL'S OFFICE,
Washington, February 21, 1876.

Respectfully submitted to the Secretary of War with reference to the preceding indorsement from the Chief of Engineers, to which attention is respectfully invited.

E. D. TOWNSEND,
Adjutant-General.

REPORT ON LINES OF COMMUNICATION BETWEEN COLORADO AND NORTHERN AND WESTERN NEW MEXICO.

The long detour in passing from the present end of railroad communication in Colorado to Fort Wingate, in New Mexico, has made a shorter route desirable for some years past. With a view to improving and shortening this route, the department commander directed an examination to be made under the orders of the commanding officer of the district of New Mexico, and in 1872 the acting engineer officer of the district, Lieut. C. C. Morrison, Sixth Cavalry, was engaged for two months in a reconnaissance of several routes. The results, though valuable, not being conclusive, the subject was again considered, and verbal directions guided the design and main features of the survey, now to be reported upon. A schedule submitted by myself was approved, and was carried into effect as detailed in the report of Lieut. G. S. Anderson, Sixth Cavalry, to whom was given the direction of the survey. I myself at the time was engaged in the personal supervision of the construction of a wagon-road from Santa Fé to Taos, N. M.

From Fort Garland to West Las Animas and to Pueblo, fine wagon-roads have existed for many years. From West Las Animas to Pueblo, a projected line of railway was at that time in contemplation, and is now in process of construction as a continuation of the Atchison, Topeka and Santa Fé Railroad from West Las Animas, to which point it has recently been extended. The Denver and Rio Grande Railway have

graded a line from Pueblo south to the Cucharas River, and at the time of the survey were not only working on this line, but talking of still further extension to the west, even into the valley of the Rio Grande.

For these reasons, I selected Fort Garland as the best point to the west of the Sangre de Cristo range from which to start the survey.

The general direction chosen was south-southwesterly to the headwaters of the Puerco River, near the nortwestern extremity of the Gallinas Mountains, where connection would be made with the work of Lieutenant Morrison. Lieutenant Anderson left Fort Lyon with his party May 30, 1874, and commencing his survey at Fort Garland was engaged in the work until July 15. He then broke up the party, and returning to Fort Lyon July 20, reached this place July 24, submitting his report immediately.

Owing to the commencement of hostilities in the Indian Territory, Lieutenant Anderson was not allowed to prepare as full a report as would have been desirable, and as he was in the field for six months, and shortly afterward his regiment was ordered to Arizona, I have not been able to obtain as complete details as many points require.

I shall now proceed to give a brief description of the present lines of communication between the railroad and Fort Wingate, and then, by comparison, invite attention to the principal features of the new route.

DESCRIPTION OF EXISTING LINES OF COMMUNICATION.

From the Arkansas River to the southern points Sangre de Cristo range.—The present point of departure for New Mexico from the railroad is West Las Animas, Colo. The recent extension to this point from Granada of the Atchison, Topeka and Santa Fé Railroad has concentrated here for the present all trade passing over this and the Kansas Pacific Railways. The route followed by freight to the south is known as the Dodge road. This, going to the east of the Raton Spur, avoids the pass of that name, and is more direct. It joins the stage-road, which goes through Trinidad, in the vicinity of Fort Union, and is, by some eighteen miles, the shorter of the two. The regular stage-road from Pueblo to Fort Union is only five and a half miles longer than the short road from West Las Animas to Fort Union, and the farther extension of the railway up the valley of the Arkansas to Pueblo, as is proposed, would not materially alter the freighting distance to New Mexico, so long as it shall be necessary to make the easting requisite to pass the Raton Mountains, a condition apparently unavoidable by the east flank of the range.

From Fort Union to the south a distance of about twenty miles is required before the chain of mountains to the west can be approached in making the change of direction toward Santa Fé and the western portions of New Mexico. In this two hundred and twenty-five miles of distance from the Arkansas to Western New Mexico, about one hundred and seventy-seven miles are southing, while only about one hundred and twenty-two are westing. If, however, the railroad terminus should be even as far west as Pueblo, eighty-six miles farther up the Arkansas River, the condition would not be bettered, as the same southing would be required and the only westing made by wagon-road would be thirty-six miles, although the total distance traveled would be the same.

Along this portion the conditions are favorable to freighting. The grades are very good, with the exception of the passage of the Raton Mountains, which now, in the long easy slope of the customary route, presents no serious obstacle. The grass and water are ample in quan-

tity and good in quality. Delays occur frequently from incidents of the weather—unusual snows at times, heavy rains in the rainy season, or protracted drought at other periods. Still, these delays do not seriously embarrass trade nor extend over many days at a time. The altitude of the highest point, the Raton Pass, is not great enough to make any practical difference in winter or early spring between this and other portions of the road, and in fact the uniformly high altitude of the whole area in question renders the climate more dependent upon this condition than on the element of latitude, and if the route is in good condition in one portion it is apt to be so in all. In the rainy season storms sometimes cause the streams to rise so as to be impassable, but this is exceptional, and the delay is rarely more than a day or two, or long enough for the water to run out. The most important of these streams are bridged. A daily line of stages runs from Pueblo and West Las Animas, joining at Trinidad, via Fort Union and Las Vegas, to Santa Fé.

From south point Sangre de Cristo range to the Rio Grande.—The next section of the route to be described is that embracing the various roads passing from the east slope of the mountains to the valley of the Rio Grande. Of these, the most northerly is that up the valley of the Pecos River, and thence, via Santa Fé, to Peña Blanca, on the Rio Grande.

The most southerly pass is via Anton Chico and the cañon Blanco to Albuquerque, and is, perhaps, thirty miles farther south. The character of the country now becomes different from that previously encountered. The smooth roads of the prairie are raplaced by rocky hills at times, and at others sandstone strata nearly horizontal in position make the road difficult and the grass scanty. The cañons and sandy or gravelly ridges of the elevated plateau upon which Santa Fé is situated are succeeded by the sandy valley of the Rio Grande, and throughout the whole region the abundant grasses of the eastern front of the mountains are succeeded by a scanty growth, which a delayed rainy season will almost cause to disappear. In the cañons of the more northerly route the snows of a late spring sometimes cover the grazing pastures to such an extent that the starving cattle of the freight-trains, dependent entirely upon this fortuitous grazing, can hardly drag light loads over the heavy roads. Although the main chain of lofty mountains abrubtly breaks down in the vicinity of Santa Fé, still the plateau itself maintains its high altitude, and is nowhere lower than 6,000 feet, continuing in a southwest direction until south of Albuquerque, when high mountains again appear. Isolated masses like the Placeres and the Sandia Mountains form obstacles which are avoided only by following down the cañons which seam their sides. From this plateau to the valley of the Rio Grande, by all the routes, necessitates a descent of 1,500 feet in from ten to eighteen miles. The greater portion of this fall is by one road concentrated in one tremendous hill at La Bajada. The ascent to this plateau from the east is fortunately more gradual, and from Anton Chico, which has about the same elevation as the Rio Grande at Peña Blanca, from thirty to forty miles may be given as occupied in the rise. The valley of the Rio Grande is fortunate only in the abundance of good water. The universal occupation of tillable ground by a crowded population allows no pasturage that is not already overstocked, and the sandy mesas furnish a scant substitute, which is only too kindly described as "poor." The roads are good in some places, but are more often sandy. The only route, however, in which the valley of the Rio Grande is followed for any distance is in going from Santa Fé via Algodones and Albuquerque, where twenty-three miles are located in the valley.

From the Rio Grande to Fort Wingate.—From the Rio Grande to Fort

Wingate two routes are followed: the lower, via Albuquerque, one hundred and twenty-four miles; the upper, to the west from Peña Blanca, one hundred and fifty miles.

The latter, passing through the rolling foot-hills of the Valles and Jemez Mountains, and across the shattered remnants of the extremity of the lava-field of the Rio Grande, is tedious with sand, and broken with low gravel-hills as far as the Jemez River, at San Ysidro. Scanty grass is the rule, and there is no water between the Rio Grande and the Jemez.

After leaving this portion the road improves, and, although rolling and broken, the lava formation of the first few miles no longer appears, and the absence is not a loss.

At the Rio Puerco the new or proposed route comes in from the north, and from this point to Fort Wingate the two coincide. Water can be found every twelve to eighteen miles; the grazing improves in quality and quantity as one goes farther west; and the road is fair—never very good, never very bad—with sand and clay. The lower route meets the same obstacle after crossing the Rio Grande. Heavy sand-hills and a desolate rolling country separate the dry bed of the Puerco from the Great River of the North. Upon reaching the bed of the San José a good road is met. Gypsum disappears, muddy pools become a running stream, and there are agricultural spots. At Blue Water, thirty-eight miles to the east of Fort Wingate, the other route is joined. These two lines deviate from a direct line in order to pass the imposing mass of Mount Taylor, and one passes to the north as much as the other to the south. This huge peak rears its lofty form, superb in grandeur and regal in its isolation. Scarred volcanic rocks drift down its sides and are lost in its vastness. Its huge base of thirty miles in length and fifteen in width forms a worthy foundation to the structure, piercing to the skies. Easily seen from Santa Fé, one hundred miles to the east, it is the monarch of these desolate, weather-worn, and wasted lands. Sandstone mesas, water-washed, reach out from the mountain's skirts and repel approach.

Over both routes freighting can be done, and easily; but the difference between the "plains" and these barren mesa-lands, with their scattered pools of water and scant grass, is very great. Over the upper road a regular mail-route has recently been established, a buckboard going twice a week from Santa Fé to Fort Wingate and returning.

Although freighting and, indeed, communication of every kind has heretofore passed from the east to Fort Wingate by the route just described, almost exclusively, still it is not the only way in which it might be done. In lieu of making the detour around the Santa Fé end of the mountains, they may be crossed to the north and the road correspondingly shortened. As will be shown, there was good reason why this was avoided until very recently, and for further reasons it will always be accompanied with objections unless natural obstacles are converted into aids.

By Fort Garland and the west of the mountains to Santa Fé.—Wagon communication between Pueblo and Santa Fé, by the western side of the Sangre de Cristo range, has been possible for many years. It has always been very difficult until recently; but with the completion of the military road from Santa Fé to Taos, a great improvement has been made. From Pueblo, or, indeed, from Las Animas, to the passes, we find excellent wagon-roads over hard prairie or by the slopes of the foot-hills. Abundant grazing and good water can always be found. The country is well populated with stock-farmers, and there is also increasing attention given to agriculture. The stage-road from Pueblo to Trin-

idad passes by ranches wherever agriculture seems possible; and, indeed, the recent conversion of the gravelly, barren mesa south of Pueblo into a beautiful village, with shady streets of green trees, strikes the traveler from the Eastern States as little short of miraculous.

Crossing the mountains.—The mountains are crossed by toll-roads built over the Sangre de Cristo and Abeyta Passes. By long gentle slopes the ascent is made up the valleys of mountain-streams, with abundance of good grass, water, and timber at every spot. The approach to the summit is steep but short, and the descent on the western side is very gentle and is made through similar surroundings. The beautiful high valley at the summit seems intended to invite a rest before encountering the monotonous plains on either side, or after the fatigue of the ascent. The snow need not block the passes longer than the plains. With sufficient travel to keep the road clear, there would not be any interruption during the year. A fall of snow remaining on the plains would of necessity stop all freighting, but when it melts there it will also in the pass, except in a few narrow and short cañons which could be cleared if necessary. There was no interruption during the winters of 1874–'75.

The San Luis Park and its roads.—The San Luis Park is entered at the foot of the pass, and at this point Fort Garland is situated eighty-one miles from Pueblo, and one hundred and sixty-one miles from West Las Animas. From Fort Garland to the west and north, through the San Luis Park, fifty-five miles of natural road from the commencement of the route to the San Juan mining district, thirty-eight miles to the southwest over an excellent natural road, excepting only the crossing of the Rio Grande, forms the first section of the proposed route to Fort Wingate and Arizona, fifty-five miles to the south over the same excellent and level road furnished by the San Luis Park, will bring us to the Rio Colorado on our way to Santa Fé. A fine grazing country, with abundance of mountain-streams, the only drawback is, perhaps, that the number of cattle on the range is too great, and the pastures are overstocked.

We now commence to cross the foot-hills which reach out to the river or near it, and the Park is left with many feelings of regret and longing for its beautiful roads.

Rio Colorado to Taos.—From the Rio Colorado to Taos, about twenty-five miles of bad road are encountered; steep hills, up and down which the road goes without the slightest regard to the action of gravitation, are additionally annoying to any one who will notice how easily they may be turned or the road relocated on reasonable grades. The soil is good, and grazing abundant, and water is found almost anywhere.

The pine forests of the mountains come down over these foot-hills, and there is a surprising quantity of fine timber. The valleys of the streams are found in cañons, and the lava-field of the Rio Grande has spurs stretching up these cañons to the permanent ruin of all roads found therein. In order to make this section of road really safely passable, work must be done between the Rio Colorado and Taos to considerable extent.

In the valley of Taos is found at present the most valuable agricultural district in New Mexico. A population of 7,000 is engaged mainly in the cultivation of wheat and corn. Two flouring-mills are supported in the manufacture of what is considered peculiarly fine flour. Large quantities of this flour are consumed in Santa Fé, and during the past year the contract for Fort Union was held by parties who filled it from this region.

Taos to Santa Fé.—Between Taos and Santa Fé there formerly existed a very disagreeable passage by a steep and bad road over a mountain-spur reaching from the main chain to the cañon of the Rio Grande. This spur, called the Picuris range, could be avoided only by a long detour crossing the Rio Grande twice. Freight, except such as could be carried by burros, was almost prohibited, and the customary route for individuals going from Santa Fé to Fort Garland, was via Fort Union and the Sangre de Cristo Pass in preference to attempting the more direct line.

Now, however, through the munificence of the General Government, a new road has been constructed down the cañon of the Rio Grande, and a level route, straighter than either of the old roads, can accommodate all possible travel.

The last forty miles of this route pass through a country remarkable for its barren desolation; hills of drifting sand or gravelly soil support almost nothing, and every spot capable of cultivation is occupied. Freighting by cattle-teams must always be very difficult through this region. It should be remarked, however, that the approach to Santa Fé from any direction is but a slight improvement on this picture. Arriving at Santa Fé from Pueblo we have saved eighty-one miles in distance over the present stage-road via Trinidad and Fort Union. With the improvement in the road made between Taos and the Rio Colorado this line would be far preferable as a stage-route from Pueblo to Santa Fé and the south, and, as it is, several days may be saved in travel by Government teams passing between the two places, and drawing their forage from the regularly-established agencies. From Las Animas to Santa Fé the two routes differ only by eight miles, and each extension of the railroad up the Arkansas River will shorten the distance by the west of the mountains without influencing that on the eastern. We have now looked at all of the existing routes to the region in question.

Perhaps, were the freighting conditions equally as good by the west of the mountains as by the east, there would be no cause to improve upon the route last described. But we are here confronted by two rather remarkable physical features of the country, which it might be interesting and instructive to describe.

Lava-field of the Rio Grande.—In the first place, there is the lava-field of the Rio Grande. This is a tremendous exhibition of volcanic power. Commencing at the angle between the Conejos River and the Rio Grande, in Colorado, one continuous sheet covers the face of the country to the south for eighty miles unbroken, and then for fifty miles farther is now exhibited in outlying areas and detached masses, separated from the main body only by the exercise of the power of erosion through prolonged ages. One hundred and thirty miles in length, and perhaps thirty in breadth at its widest place, the area of a principality lies swallowed up forever. From craters existing, probably, in the San Antonio Mountain and the Ute Peak, and possibly in other centers, this flood poured over the land. Reaching to the east, it was checked by the mountains of the Sangre de Cristo range; flowing to the west, the mountains and hills of the main divide and the spur now between the Chama and the Rio Grande limited its extent. To the south it was deflected westwardly by the spur of the mountains called the Picuris range, some fifteen miles south of Taos. Protected by this spur, we find the east bank of the Rio Grande for many miles free from the flow. Confined on the west by the slopes of the Jemez Mountains, the breadth of the field is narrowed; but from the village of San Ildefonso to Peña

Blanca we find the lava on both sides of the Rio Grande, spreading to the east as far as the valley of the Santa Fé Creek. Secondary centers in the Jemez Mountains possibly contributed to this extension, but the main force of the eruptions was probably felt farther to the north. However, in this vicinity the edges and extremity of the field have been reached, and there has been so much erosion at places since its deposition that outlying masses, as in the bluffs to the west of San Felipe, alone remain. Throughout the whole region thus depicted this lava-field is the great and controlling element. The streams that have eaten their way through it with untold difficulty, are found in narrow and deep cañons, having no land for cultivation. A dangerous feat for man to descend these precipices, the passage by an animal is almost impossible. The Rio Grande passes for eighty miles or more through its black abyss, with walls of seven or eight hundred feet in height crowned with perpendicular cliffs of solid lava two and three hundred feet high. Throughout the whole region there is no agriculture. The valley of Taos is formed only by the fortunate detrition of the adjoining mountains spreading over the edges of this plain a thin soil. Outlying patches are cultivated at other points near the perimeter of the basin. Agriculture on the Rio Grande is possible only, as before alluded to, in the section that was, so to speak, in the lee of the Picuris range, or from La Joya to San Ildefonso. The surface of the mesa itself supports a scanty grass which feeds a few wandering flocks of sheep, and the dwarf cedar proves anew its wonderful hardiness. In consequence of these features roads across this country are almost an impossibility. From Cienigilla to the Ojos Calientes is found the only wagon-road crossing the mesa from east to west.

The fortuitous cañon of the Rio Chama furnished a route from Santa Fé to the northwest. From Peña Blanca to the west the road is possible because of the erosion of bluffs which were probably as formidable once as those of San Felipe, ten miles to the south.

The road from Fort Garland to Taos keeps to the east of the basin, touching it only at the Rio Colorado and at the Arroyo Hondo. Lieutenant Morrison's route in 1872 is unavailable because of passing over the western shore of this no longer sea of fire, where sterility and absence of water are the rule.

In the construction of the military road from Santa Fé to Taos it was necessary to follow the cañon of the Rio Grande from La Joya to Cienigilla, and the expense of the construction arose from the necessity of passing through the blocks of lava forming the *débris* at the foot of this gigantic mesa cliff.

Under these conditions the problem of passing to the west of this section becomes a strategic one of turning its flanks. The routes via the south point of the Santa Fé range turn it to the south as well as the range itself. The proposed route will turn it by the north.

The marls of Santa Fé.—The second physical feature remains to be described. Underlying this gigantic field of lava, probably throughout its whole extent, certainly in its southern portion, there exists a series of immense beds of marls, sands, and clays, and imperfect sand and limestones. Of many hundreds of feet in thickness, the coarse character of the sand and the immense quantities of gravel show that they are formed by the very rapid erosion of a lofty mountain-range. From this cause the formation of a finely comminuted soil has been impossible. Barrenness and desolation are the results, and the country to the south of the Picuris range and Santa Fé and its vicinity suffers accordingly.

The foot-hills of the mountains and the valley of the Rio Grande are alike sandy and sterile. Narrow strips of ground are irrigated in the immediate vicinity of the streams, but away from these feebly-green spots aridity and bleakness extend. There is no grass except during the few weeks succeeding an usually protracted rainy season. Cattle learn to eat anything that is green, and the sight of the goat eating the thorny stems of the tall cactus is no more striking to the stranger than to see the gaunt ox feeding on the running pine and the dwarf cedar. Sheep and cattle are driven from this region to the "Conejos Country," full sixty miles, to pasture and to winter. The valley of the Chama is similar in its character, being formed by the excavation of the same beds of marl, and the Rio Grande below the junction of this stream never loses its predominant characteristic of sand. These marls extend to Santa Fé and farther south. The Santa Fé Creek irrigates a small portion of tillable land some six miles or more in length in the immediate vicinity of Santa Fé. Besides this and a starving hamlet at Galisteo no sign of civilization breaks the desert solitude of sand and gravel that stretches southwardly down this elevated plateau, save the isolated ranches near the rare springs of water, such useful oases in the passage of this divide. The civil division of the country of Santa Fé very nearly covers this barren area from the Rio Pojoaque to Galisteo. In this country, with a population, by the last census, of 9,699, there is reported as the total area of improved land 10,925 acres only, with a total annual value of farm-products of $99,410, or about $9 per acre. This in a country where corn is cheap at 2 cents per pound. The production of wheat was given at 6,314 bushels and corn 20,262 bushels. Beyond necessary working-cattle and horses no stock except sheep are kept in this region; 630 having been reported as the total of "other cattle," held in the country. To avoid the lava-field in going to the West by the South from Fort Garland we necessarily encounter at least sixty-seven miles of this desert.

It might not be an impertinent digression at this point to answer the question why was Santa Fé established in the face of these disadvantages? Its lovely climate, protected as it is from the north by its near mountains, and elevated at 6,840 feet into an atmosphere charming in its freedom from moisture and balmy in its mildness, may perhaps have had its influence. An abundance of excellent water is found at a short depth by digging wells at almost any point of the locality and fresh and sweet; it alone in those regions is reason sufficient for settlements. The immediate vicinity probably supplied its earlier inhabitants with sufficient food for their limited numbers. By reason, then, of these two formidable features it has not been advisable heretofore to use the route thus described in passing from Colorado to Western New Mexico. As shall be shown, however, it is more than probable that early progress in railroads shall make this route a desirable one to Southern New Mexico in case it shall be improved, as indicated before, between Taos and Fort Garland.

It is now necessary to describe the lines of reconnaissance and survey examined in search of a new route, and to give a general view of the country through which they pass.

DESCRIPTION OF NEW ROUTES SURVEYED.

Lieutenant Morrison's route in 1872.—In 1872 Lieutenant Morrison made a reconnaissance by the west side of the Rio Grande. Crossing the river at Meyer's Ferry, he went down the lava-field near its western edge to Ojo Caliente; thence by a long curve to the west and north he

crossed the Chama some fifty-three miles from Ojo Caliente; from this point down the course of the Puerco to the road from Peña Blanca to Wingate, and with it to that place. Unfortunately his report was not as full as it might have been, and I shall endeavor to supplement it from other sources.

It is an interesting historical fact that during the suppression of the Indian insurrection in New Mexico by the Spaniards in 1690–'93, an expedition to conquer the Pueblos of the Taos Valley, having been longer in its undertaking than presupposed, found itself blocked up on its return to Santa Fé by snow in the Picuris range. Fearing to attempt the passage under the circumstances, the plan was adopted of going north into the Utah country, now Colorado, crossing the river above the cañon of the river Grande, probably in the vicinity of the Rio Costilla, and then returning to the south. The line of march on the west side of the river was the same as that followed by Lieutenant Morrison, and the lapse of one hundred and eighty years has found us in nearly as intimate a knowledge of this country as the Spaniards had then.

Conejos to the Chama.—The lava country, of course, through its whole extent, furnishes hard roads, level in stretches, and very rough from detached fragments, which have an almost perfect hardness, weathering very slowly and never crushing into macadam. The cañons of the water-courses on this route and the edges of the field are descended by very rough and very bad roads, incapable of permanent improvement, and not even easy to be bettered.

The longest distance without water is twenty-five and one-half miles, being that from leaving the Conejos and its tributaries to some water-holes on the lava-field. The last stretch of seventeen and one-half miles into Ojo Caliente is without water, and as the road has left the lava, the sand of the marl formation thus discovered makes the traction difficult.

Rolling country and steep hills between Ojos Calientes and the crossing of the Chama, in addition to the undesirableness of the preceding section, do not tend to reconcile one to the long detour thus made between the Conejos and Upper Chama in order to avoid the mountains of the direct line. In this section Lieutenant Morrison examined three routes, and of these recommended one which would necessitate some work before it could be used by wagons. The others have objections to their use in being longer and in other features of a physical character.

Were the curve of the more level route located through a prosperous region, or were the roads smooth and quickly traveled with good grass and abundant water at reasonable distances, it might not be considered worth while to attempt to shorten the line by passing over a chain of mountains. But when the mountain-route has its usual advantage of water at all points and good grass, and its grades are fairly reasonable, the question of cost of construction may well be considered. And when in addition to this the saving in distance, as in this case, amounts to fifty-five miles, the economy of a judicious investment is well nigh manifest.

The Jemez Mountains.—The mass of the Jemez and Gallinas Mountains necessarily deflected Lieutenant Morrison's line, and the northwestern point of this obstruction was the objective from Fort Garland selected by me in the line surveyed. The mountains form a bold and imposing feature in the landscape. Rising in swelling masses and terraces, they are always grand in effect and graceful in outline. Culminating in one high summit, every defense of bastion and outlying rampart seemed combined for its protection, alike from the attack of

man or the fiery onslaught of natives. Though lofty enough to be surrounded by the summer-clouds and darkened by the summer-storms, these mountains are not of sufficient area to form and protect mountain-streams, as does the Sangre de Cristo range. Agriculture, therefore, is represented only by the scanty fields of the Jemez River or the withered banks of the Puerco. No communication exists through its forbidding cañons, nor indeed does the prospect even invite a search.

Rio Chama to Wingate.—To the westward still we find the great Atlantic and Pacific divide, with a general direction of south-southwest. Having turned the Gallinas Mountains, our crossing of the Rio Chama is found to be probably not more than fifteen or twenty miles to the east of the crest of the divide. From this point to Blue Water station, a distance of one hundred and forty-seven miles, the road is sensibly parallel to the line of the crest. Bacon Spring is found on the west, and is the first water encountered on the Pacific slope.

The general character of the country, from the line of the road to the north and west, is very much the same everywhere. Recent sedimentary rocks, and soil from their detrition, are the geological features. The altitude of the divide is not great, rarely over 7,000 feet, and the rain-fall is very slight. But the soft soil washes very easily, and the water-courses to the west become cañons at short distances from the sources. Two of these cañons have been carefully examined and described.

The Cañon del Chaco was reported by Lieutenant Simpson, in 1849, to contain remains of a former population of considerable size. Its rocky walls now look down only on a dry bed and dusty ruins. Pueblo succeeding pueblo formerly lined the banks of what must have been a fertile river-valley. To-day not even is it safe for the passing train to depend upon finding sufficient water there except during the rainy season.

Capt. J. H. Macomb passed through the Cañon Largo in 1859, finding it still more desolate than the Cañon Chaco, although exhibiting ruins indicating former habitation. The great divide itself is not a precipitous chain of mountains, but rather a rounded plain, and the whole country is made up of approximately plain surfaces, now cut up into gigantic sandstone mesas, crumbling, dry, and barren. The only routes that can be followed are by the gorges between. It is impossible to cross the system, save with much work and many detours. The topography of this feature is well illustrated by the detail sheets of the accompanying atlas and also by the general map.

However desirable it might be to rectify the line of the route between Chama and Fort Wingate, it would be difficult, if not impossible, to do so with a wagon-road. If we pass to the west, we shall find ourselves on the dry crest of the divide; if still farther to the west, we are in a dearth of water, and a difficult line of travel for all possible reasons.

New route proposed for construction.—Having thus discussed existing lines and the difficulties encountered, the remainder of the description is confined to the portion which is recommended for consideration as to the propriety of constructing a new road. From the Rio Conejos to the Rio Chama, the line surveyed is reasonably direct; the distance, as the crow flies, between the two extremities being about fifty-three miles, while the route chosen by Lieutenant Anderson is sixty-four miles in length, a very slight difference, if it is recollected that 10 per cent. is the usual allowance in the difference of distance between a mountain, or even rolling country-road, and one on the level between two points with the same air-line distance. With this allowance, the curvature will be less than 10 per cent.

As can be seen from the details given in Lieutenant Anderson's report, all the essentials for freighting are found at all points. In passing the divide the line follows the course of some stream all the time, and thus, as in all the mountain-passes in this region of country, the facility of stopping wherever desired makes the passage easier. The distance to be worked is sixty-four miles, and the route chosen by Lieutenant Anderson is approved, with the correction of passing directly down the entire valley of the Hutrias to the ford of the Chama. It is to be noticed here that one objection to this route lies in the fact that there may be snow on the pass during the early spring. In all probability when the Sangre de Cristo pass is free from snow, these mountains will be equally clear, and, at any rate, nine months in the year certainly will be available for all kinds of travel. In the construction of the road, I believe the idea of soldier-labor had best not be entertained. The constant employment during the season of cavalry, and the frequent calls for infantry, would make their labor difficult to procure, fitful, and expensive.

The New Mexican settlements on the Conejos and at Tierra Amarilla, are numerous, and would furnish all the labor necessary and at reasonable rates. From my own experience with Mexican laborers I feel safe in saying that it would be difficult to hire as good men at higher wages in portions of the country where more frequent opportunities of such employment may be found.

I have not been able to collect as exact information concerning the settlements on the Chama as I could wish. From personal acquaintance I know, however, that the Tierra Amarilla country is considered by the inhabitants of the Rio Grande district to be good land, and as this is supported by the census, it is probably correct. During the ten years from 1860 to 1870, although the population of the two counties, Taos and Rio Arriba, has decreased a few hundred, there has been an increase of about a thousand souls in the Abiquiu and Tierra Amarilla precincts; this change being undoubtedly from emigration from the other portions of the counties. The quieting of Indian troubles has probably led to this result, as this region is considered much more favorable to stock-raising than further to the east. The transfer of population referred to is almost entirely concerned with the native Mexicans, and one acquainted with the strength of local ties of this race knows that starvation or hopes of betterment, or both, would be required as incentive sufficient for such emigration. The grazing in this vicinity and in what is known as the "Conejos country," the high land of the northern end of the proposed road, is considered fine enough to warrant the driving of flocks of sheep from the Rio Grande, near the mouth of the Chama, to this pasturage, a distance of at least sixty miles, and cattle are also driven to this region for wintering from the same localities.

What is known as the old "Spanish Trail" to the west passed from Santa Fé up the Chama and through the Tierra Amarilla country, thence crossing the tributaries of the San Juan near the foot of the range. This was surveyed by Capt. J. H. Macomb, 1859. Since the opening of the San Juan mining-region there has been considerable travel by this route to the mines, passing up the Animas River.

The impulse to trade has been slight, but it has been something, and merchandise from Taos and from Santa Fé has gone in this direction. All things considered, this immediate section is the only one in the northern and western portions of this Territory which has an upward look.

GENERAL VIEW.

Having now completed our particular examination of local regions and lines, I propose to give a general view of the situation, embracing both natural and artificial features.

The active rivalry of three railways, the Denver and Rio Grande, reaching to the south; the Atchison, Topeka and Santa Fé, to the south and west; and the Kansas Pacific, endeavoring to prevent the two former from cutting off its resources in those quarters, has already produced valuable results to New Mexico and to the public at large, whatever be the effect upon the owners of the railways or their creditors. Each effort of one to extend its reach is met by a corresponding move on the part of the other. At the moment of writing it is asserted that the rails will be laid from West Las Animas to Pueblo by February next, also that by the same time the Denver and Rio Grande will have ironed its track to the Cucharas, fifty miles to the south of Pueblo. The Kansas Pacific has laid a few miles of track to the south of the Arkansas, and talks of reaching Trinidad in a short time. There is no doubt, at any rate, that all will be done that can be with the resources at command, and that the extensions will be only a matter of time, means, and natural obstacles. Railroad building in the valley of Arkansas and even over the prairies is a different matter from construction among the foot-hills of the range, or from the problem of crossing the latter. The north and south line of the Sangre de Cristo range presents an almost unbroken front from the Arkansas River cañon to Santa Fé, and certainly at present the prospect of its being crossed is not good. While there is nothing very difficult in construction to be encountered, the expense would be much greater than on more level ground, and the grades would always be heavy and the running expenses proportionately great. A uniform grade of 150 feet at the least to the mile would be necessary for fourteen miles to make the pass, or more likely lighter grades at first and heavier near the crest. While this can be done, and the experience in the cañons of Colorado near Denver show that it may be advisable, still in this case there are no rich and well-established gold-mines at the end of a short route, but instead thereof very little trade, and that to be fostered and built up, and it is altogether unlikely that this passage will be attempted immediately. Again, in the direction of Trinidad the bold and high spur of the Raton Mountains offers to the southern passage grades almost, if not quite, as severe as the other line. The continuation of this spur to the east by the Mesa de Mayo and the cañon of the Dry Cimarron has indeed formed the great obstruction to railroad extension toward New Mexico from Kansas and Colorado heretofore. For the same reasons as in the preceding case, it is not likely that any prolongation of either of these lines would be made beyond Trinidad for several years, even supposing the inducement of the fine coal of the vicinity attract them thus far. In all probability, then, two points, one, Trinidad, and the other not far from the foot of the Abeyta or the Sangre de Cristo pass, may be considered as the virtual termini of the system of these three railways.

From Trinidad the southern trade can be reached by the present stage-road over the Raton Pass, and as wagon-roads are being constructed or improved up the Purgatory to the Moreno mines, and across the range to Costilla, in the valley of the Rio Grande, a new system will here be opened.

Through the Abeyta Pass the trade of the San Juan mining country will go, and probably some of the Santa Fé trade also. In case of the

improvement of the road from the Rio Colorado to Taos, all the military freight for Santa Fé and for Southern as well as Western New Mexico will undoubtedly pass this way. From either point no advantages can be obtained by a farther southern extension which cannot be as well gained, together with others, by a westward direction into and over the range. If we now examine the map and recall the physical features already described, we shall see that from these two points we must have converging lines to the west, the one from the more northern point, crossing the range and the Rio Grande to the southwest; the other, from Trinidad, must cross the Rio Grande above its cañon, and the two naturally intersect at the villages on the Conejos or the initial point of my survey. This, then, is the key of the whole situation. If the shipping-point be the Cucharas, the better of the two, the shortest and best line to the southwest is that direct to this point; if from Trinidad, the result is the same. From the location of the initial point, the next step is a certainty. The Rio Puerco must be reached by the shortest line, and then it must be followed.

It is impossible to locate a general route to the west of this line, because of the bad lands of the Atlantic and Pacific divide, and it would be unadvisable to select a direction to the east, because of the lava-field and the Jemez Mountains. It would be unwise to remain on the east of the Rio Grande, because of the detour to the south and its features. A careful consideration of these general conditions leads us to the conclusion that for many years the shortest, best, and most advisable wagon-road will be located about as described and recommended for construction.

It only remains to call attention to the needs for such a road and its advantages.

INTERESTS AFFECTED BY PROPOSED ROAD.

The post of Fort Wingate was established when the Navajo Indians were removed from their reservation on the Pecos River to their present one, the latter being their native home before their subjection by the Army. The garrison is intended as well to protect these Indians from the whites as to impress upon the former that they are no longer the lawless marauders of the preceding decade. The tribe is the most important one in New Mexico. They are intelligent and superior, physically, to any other of the neighboring natives. They have always maintained a high reputation for innate industry, having engaged in agriculture as well as in manufacturing many articles of domestic life. They are now quiet and law-abiding, and are reported to be anxious to improve, and are willing to work. In fact, if there be any prospect of a radical improvement in the red man in this region of country, the Navajos offer the only hope to the sanguine. They number over 9,000 now on the reservation, and are considered not to be decreasing in numbers. They are contented with their reservation and their fate, and we cannot foresee any likelihood of a change in their temper, feelings, or welfare likely to lead to a change of location.

The garrison at Fort Wingate is, therefore, the most permanent as well as the most important in New Mexico, and good communications to it from other posts and from the supply-points should be more carefully sought for than to any other points. Two companies of cavalry and two of infantry have been the ordinary garrison, and subsistence-stores, clothing, and camp and garrison equipage, and miscellaneous quartermaster stores must be freighted there from the east. The estimated

annual allowance for such a garrison is about 628,000 pounds. The post of Camp Apache in Arizona has been supplied of late years from the East, via Fort Wingate. Allowing half as much more for this garrison, and we have an annual total of about 942,000 pounds. At the present very reasonable rates of freight on this contract, a saving of one hundred miles of distance would result in an economy of $7,573 per annum. Besides this, an allowance should be made for the stores shipped for the use of the agency at Fort Defiance. These are brought over the same route, and although they probably are not of great weight or value, they should be considered. I am unable to report the exact figures, not having access to the proper sources of information. The appropriation for the support of this particular tribe, last reported, was over $80,000.

The fact that stores are shipped to Camp Apache from the East now, shows that every extension of the Colorado Railroad system, and every improvement in connecting roads, will lessen the expenses of the military service in Arizona by extending the perimeter which can be supplied from the East as cheaply as from the West. The unlikelihood of railroad enterprise in Arizona from the Pacific side makes it the more incumbent to stimulate advances from the East.

A secondary consideration should here be considered. The San Juan mining district, occupying the mountains at the head of the Rio Grande and almost exclusively on the Pacific slope, has been growing in importance, and has been filling up with the usual class of population. Although the mining operations are now conducted on lands ceded by the Ute Indians, experience shows that there will be no hesitation in extending their prospecting on to lands belonging to the Indians, and exciting thereby their dissatisfaction, if the miners should so desire. In that case a military force would be called for at once, and the probable result would be that a permanent post to the west of Fort Garland and looking upon the mines would be established. One of the present routes to the San Juan country is up the Rio Grande, and making the pass at the head of that stream. This pass is 12,370 feet high, or nearly 3,000 feet higher than the Sangre de Cristo Pass. The other pass is via Saguache and the Lake Fork of the Gunnison River, crossing the divide to the head of the Animas River at an elevation of 12,150 feet.

From the fact of the high altitude of these passes, the snow lies deep and long into the spring. From the reconnaissance made under my directions in the spring of 1873, it was reported that on the 9th of June, in crossing this divide at the head of the Rio Grande, nearly three miles lay "over and sometimes through continuous sheets of snow, in many places of great but unknown depth, generally, however, from 4 to 8 feet." On the 25th of June, on the pass from the Animas River to the Lake Fork, the report says, "There was much very deep snow, which fortunately bore the animals and bridged many gorges which would make the pass nearly impracticable without the snow." This remark applying only to pack animals, was verified during the summer of 1874 by Captain McCleave, Eighth Cavalry, who was compelled to take pack animals in making the trip to the mining regions by this road. By passing to the mines by the lower route, crossing the Chama spur by the proposed wagon-road, the Atlantic and Pacific divide is crossed at an elevation of only 7,600 feet, and the outlying hills are nowhere reported over 8,000 feet. The Animas River is reached at the elevation of 6,410 feet, and, following up that stream, the road nowhere exceeds 10,500 feet in altitude, and the elevation of Baker's Park itself is 9,600. A route averaging 3,000 feet less in altitude must be equivalent to a month

or six weeks' additional time in the spring, and this fact may well be considered in the formation of an opinion on its desirability. This lower road can be and is used by crossing the Rio Grande at Cieniguilla and thence by Abiquiu or El Rito to Tierra Amarilla, but the detour for military purposes from Fort Garland would amount to fully sixty miles.

The following tables give the various distances from the present termini of the railroads to Fort Wingate by different routes, and the distances from the probable termini of the railroads on the 1st of July next.

By proposed route:	Distance between intermediate station.	Distance from Pueblo.
Pueblo to Fort Garland	81.14	81.14
Initial point of survey	38.00	119.14
Crossing of Rio Chama	63.98	183.12
Puerco Station	83.06	266.18
Fort Wingate	102.41	368.59

Fort Wingate to West Las Animas:	
Via Fort Union, (tables of chief quartermaster Department Missouri)	474
Via Trinidad and Fort Union	486
Via Santa Fé and Fort Garland	488
Via Lieutenant Morrison's route of 1872	504
Via proposed route	448

Fort Wingate to Pueblo:	
Via Trinidad and Fort Union	476
Via Fort Garland and Santa Fé	408
Via Lieutenant Morrison's route of 1872	424
Via proposed route	369

Fort Wingate to Cucharas Station:	
Via Fort Union	424
Via proposed route	347

Fort Wingate to Trinidad:	
Via Fort Union	385
Via Costilla and proposed route	339

Santa Fé to Cucharas Station:	
Via Fort Union	254
Via Fort Garland and Taos	210

Santa Fé to Pueblo:	
Via Fort Union	305
Via Taos	232

Santa Fé to Cucharas Station via Taos and Fort Garland	210
Santa Fé to Trinidad via Fort Union	215

Saving in distance by proposed route over present shortest routes of wagon-transportation between Fort Wingate and West Las Animas	miles..	26
Pueblo	miles..	105
Cucharas Station compared with present railroad terminus	miles..	125

Probable saving in distance July 1, 1876, in wagon-transportation between railroad terminus at Cucharas and Santa Fé by Abeyta Pass and Taos, over present distance from West Las Animas to Santa Fé, ninety miles.

Probable saving in distance for light or spring-wagon transportation between railroad terminus at Cucharas and Santa Fé, via Abeyta Pass, over present, via Trinidad and Fort Union, one hundred and eight miles.

Supposing the railroad termini to be at Trinidad and Cucharas respectively, the saving in distance from Fort Wingate to Cucharas

Station, via proposed route over that to Trinidad, via Fort Union, is thirty-eight miles.

With Pueblo as the terminus of competing roads, freight rates will be as reasonable there as at West Las Animas, and we can sum up the probable advantages of the constructions recommended as follows:

In case of the opening of a wagon-road from Conejos to the Rio Chama, the saving in distance by wagon to Western New Mexico and Arizona will be from twenty-six to one hundred and five miles over present and immediately prospective facilities. In case the additional incentive to railroad extension to the west be sufficient to induce the railroad companies to build into the valley of the Rio Grande, the saving will be as much more.

In case of the improvement of the road from Fort Garland to Taos, the entire Southern New Mexico trade will be benefited in the saving of from forty to eighty miles.

In view of the facts herein described, I am of the opinion that an improvement of the two lines of road from Fort Garland to Taos, and from Fort Garland to the Chama River, is desirable; and that the interest of the military service would be justified in asking for an appropriation for this purpose.

I therefore respectfully recommend that an appropriation of $10,000 be requested to improve the "military road from Fort Garland to Santa Fé, N. Mex.," and that an appropriation of $30,000 be requested to open a "military road from Fort Garland to Fort Wingate, N. Mex., by the shortest practicable route."

I submit herewith a map, showing the lines of communication described in this report and the proposed new road. I also submit an atlas of detail sheets of the survey of the road in question, and would state that were the appropriation requested obtained, work could be immediately commenced, and the road probably would or could be in use by the middle of September of this year.

I invite attention to the report of Lieut. G. B. Anderson, Sixth Cavalry, appended, and to the general tables of distances and descriptions compiled from the notes of the survey.

I am, very respectfully, your obedient servant,

E. H. RUFFNER,
First Lieutenant Engineers.

FORT LEAVENWORTH, KANS., *July* 25, 1874.

SIR: I have the honor to submit the following report of an expedition, while under my direction, for the survey of a wagon-road from Fort Garland, Colo., to Fort Wingate, N. Mex.

By the letter of May 13, 1874, from the assistant adjutant-general Department of the Missouri, I was directed to take charge of an expedition "engaged in examining the practicability of building a wagon-road in a direct line from Fort Garland, Colo., to Fort Wingate, N. Mex.," and the following was given me as a "schedule of route:"

Fort Garland to Rio Grande at most convenient crossing both for road and river.

Leave Rio Grande, going up the Conejos and across the divide to the headwaters of the Chama Rivers.

Down the west side of the Chama to the west of the Jemez Mountains and the divide between the Chama and the Puerco. In this schedule the important point is the finding of an easily-worked and good-grade passage of the divide between the Rio Grande and the Chama.

New routes should be shown returning.

By verbal instructions, received from yourself, I was made more fully acquainted with the nature and details of the work to be accomplished.

My report will embrace: First, a description of the organization of the party for field-service; secondly, a general account of the instrumental work done; thirdly, a description of the physical character of the country passed over; fourthly, a comparison of the two routes over which lines were run, with reference to their practicability for purposes of a road; fifthly, recommendations and estimates. The report is accompanied by an appendix, which contains a tabular statement of the distances from camp to camp and the latitudes and departures obtained by stadia-theodolite and other information.

The party was organized as follows: An assistant was placed in charge of the stadia, and recorded the azimuths of the various courses; a recorder was charged with the reading of the rods and with the topography; an escort of one corporal and seven men was employed in bearing the rods and doing the fatigue-work of the expedition.

Assistant D. W. Campbell and Recorder Samuel Austey reported to me at Fort Lyon, Colo., on the evening of May 27; on May 28 I arranged my detail and prepared for starting, but was detained until the 30th by an exceptionally severe rain-storm, which lasted three days, and swelled the Arkansas River beyond its ordinary high-water mark and rendered the road almost impassable.

The bridge across the Arkansas at Las Animas being burned, I was obliged to go by way of Pueblo to obtain a crossing. I reached Pueblo on June 2, and Fort Garland on June 5, and at once proceeded to the organization of my party for the field. Assistant Campbell and Recorder Austey were charged respectively with the instrumental work, and with the topography. Corporal Sickles, M Company, Sixth Cavalry, was given charge of the pack-train and the fatigue labor of the expedition. Private Tomson, G Company, Third Infantry, and Private G. W. Brown, M Company, Sixth Cavalry, carried the rods. I devoted my time to reconnaissance-work, and rode ahead each day to determine a line and a camp for the day succeeding.

The instrumental work performed consists of a line run from an established point on the land survey, (about 100 yards south of the convent at Conejos, Colo.,) via the Conejos and Los Pinos Rivers, and the west branch of the Chama to Tierra Amarilla; thence across the Chama and the heads of the Gallinas and Capulin Creeks to the divide at the head of the Puerco. On our return, a second line was run from Tierra Amarilla to our point of departure at Conejos, via the Nutritas Creek and the heads of Vallicita and Patoca Creeks, and the west branch of the San Antonio.

Our point of departure was 13 chains west of section corner between 19 and 20, of township 33 north, of range 9 east, of N. M. meridian. The instrument used was a stadia-theodolite, made by Alee, of Saint Louis, 5-inch horizontal limb, with two verniers reading to 20″; telescope 8½-inch focal length, 1½-inch aperture. The vertical limb read by a vernier to single minutes. The New York leveling rod, with double targets, was used, and was read by the topographer, or in his absence by the rod-man. The lower target was clamped at the "one-foot mark," in order that it might be seen in grass or low bushes, and one foot was afterwards deducted from each reading; to prevent this target from interfering with the sliding of the rods, a piece of wood was inserted underneath the back part of the rod, on which the sliding portion rested when down; a similar piece filled the interval in front and above. A od made especially for the stadia, with graduations commencing at

some distance from the bottom, would be found very useful in underbrush and over a rolling country. Horizontal distances were determined entirely by stadia readings, and the course was kept by instrumental azimuths taken by back-sights and fore-sights at each station, and by magnetic readings. Observations for meridians were made nightly, as far as the weather would permit, on Polaris.

On June 9 I left Fort Garland and marched in a southerly direction along the road toward Culebra, taking this route because the Rio Grande was not fordable and could only be crossed at Meyer's Ferry, near Costillo.

Owing to the inexperience of my escort as packers, and their need of further instruction, I only traveled about two miles the first day, and made camp on the Trinchera, whence I could take an early start the succeeding morning, with the packing performed under the direction of a practiced packer detailed for my assistance from the fort. I was provided with ten pack-mules and five saddle-mules, four of which latter were ridden by the instrumental party, and the fifth by the corporal. I had with me for my own use my horse, brought from Fort Lyon.

About eight miles from Fort Garland we passed around the east of a point of low hill called Piñon Point. The adjacent country is nearly level and the road a good and perfectly well-defined one. On the Trinchera there was water and wood in abundance, but stock-herds are becoming so numerous in the country that grazing cannot at all times be depended on. The route from this camp to our next (the No. 8 of the expedition) was across the southeast corner of the so-called San Luis Park, but the national features of the country are rather those of a desert; nothing but sage-brush grows on this barren, except on the low hills which in some places dot it, where are seen a few stunted piñons and cedars.

We passed the town of San Luis and made our next camp about four miles below it on the south bank of the Culebra, near the plaza San Acacia. San Luis is a flourishing-looking Mexican town, sixteen miles from Fort Garland, and is the largest of the series bearing the general name Culebra; it contains about one hundred houses and has a post-office, which, by the way, is also called Culebra. The creek is thinly timbered with cottonwood and bordered with an undergrowth of willows; at this time it was so high as to be unfordable, but was passed by a bridge at San Luis; ordinarily it is readily passable at almost any point. From camp No. 9 we passed down the valley of the Culebra about ten miles, and then rose the bluff to the second terrace, which we found to be a sand-plain, similar in character to the other portions of the San Luis desert. After ten miles of a journey over heavy sand, we reached the Rio Grande, but were unable to cross before the following day, owing to the stormy wind prevailing during the afternoon of our arrival there. The ferry-boat is a dilapidated affair, and it was with considerable difficulty that we were enabled to cross by it at all. Should no other means of crossing the river be provided, it will be practically impassable for teams during at least two months of each spring. At this point there was neither wood nor grass near the river.

On June 10 we crossed the river, but were occupied until noon in the passage; we then marched to a camp on the San Antonio near its junction with the Conejos, and about ten miles from the ferry. Our route as far as the San Antonio lay between lofty hills of a sandstone and lava formation; beyond this we were obliged to follow down the creek to obtain a crossing, as the bridge which once existed here had been swept away.

The valley of the Conejos, which we ascended next day as far as the plaza of Guadaloupe, is apparently very fertile, and good crops of cereals and grass are grown; it is well timbered near the banks of the stream by the bitter cottonwood, with the usual accompaniments of willow and alder. The crossing of the San Antonio was difficult, but the crossing of the Conejos would have been found impossible, had it been desirable to cross it. The river (Conejos) had formerly been crossed by a bridge near the plaza of Guadaloupe, but this was swept away, a few days before my arrival, by the high water.

The march on the 13th from the San Antonio crossing to Conejos was about ten miles, and we were early in camp. The afternoon was occupied in finding a land-survey corner from which to begin our line, and in the determination of our instrumental coëfficients.

The plazas of Conejos are named Guadaloupe, Las Pinos, Ciseneroz, San Raphael, San Antonio, Cerritos, Islan, Rincones, and Cordon, the first being the largest and contains the post-office; taken together they comprise a very flourishing Mexican settlement of near 300 houses.

On June 14 we commenced work, and ran our lines up the valley of the Conejos about seven miles and made camp; our road thus far was a good and well-defined one, leading past the plaza San Raphael and a couple of deserted settlements; the valley seemed very fertile, and was for the most part under cultivation. To the south of this valley—here one-half mile in width—is seen a mesa which rises gradually toward the west until it nears the foot-hills of the mountains, where it is broken by an abrupt descent similar to its northern and southern sides. I climbed this mesa with some difficulty, and found its flat top some 300 or 400 yards wide, covered with bowlders of vesicular lava; the valley bordering it on the south is slightly undulating and apparently without water; it is well grown with rank bunch-grass and thickly timbered about its edges with pine, spruce, and cedar. The north slope of the mesa exhibited strata of soft, gray, friable sandstone, alterating with conglomerate.

To the north of Conejos Valley is a similar formation, except as to its top, which, instead of being level and mesa-like, is terminated in two conical peaks, which project 200 or 300 feet above the vertical sidewalls.

Next day we followed the beautiful valley of the Conejos for about two miles, and then turned to the hills on its southern bank. These we found for the most part covered with a heavy growth of pine, spruce, and aspen; but along the line of our road the country was open for a further distance of about two and a half miles and well grown with bunch-grass. The Conejos emerges from a narrow and precipitous cañon, whose sides are composed mostly of basalt and vesicular lava, at a point some two miles above where we left its banks. It is here a large and rapid stream, passing over a very rocky bed; its shores are lined with a dense growth of cottonwood and an occasional large pine and cedar. We made some six miles this day, and went into camp in a heavy pine forest near a small stream flowing into the Conejos. Our line continued up this stream nearly two miles, then turned to the north and followed a tributary to its source, and passed over a low divide to the headwaters of a branch of the Los Pinos Creek. A much better road could be built over the first two miles from our camp by following the edge of the hill on the north bank of the stream we first ascended; it was impracticable to run an instrumental line there, owing to the dense entanglement of fallen pines and the thick growth of small aspens about 12 feet high which had sprung up over the ground.

Our camp was made in a beautiful open valley at the foot of a high mesa, whose sides were still covered with snow. This valley is divided by a low ridge, from the north side of which the water flows in an easterly direction into the Conejos, while the water rising to the south of it flows south into the Los Pinos, about three miles distant; this valley was marshy from the melting of the snows above it, and contained several small lakes of beautiful clear water. Bunch and marsh grasses were abundant, and the country seemed well adapted for a summer range for herds of cattle and sheep. Our mules sank into the marsh above the fetlocks, and I found travel disagreeable, and, as I at first thought, dangerous; but I soon discovered that there was a hard stratum some four or five inches below the surface through which there was no fear of penetrating.

In the evening, in company with Mr. Anstey, I walked to the south along a divide for two or three miles and reached a point on the cañon of the Los Pinos of perfect grandeur; the southern face of the cañon has but a slight inclination, while the northern one on which we stood was rather overhanging.

The water here rushed in a perfect torrent 1,200 or 1,500 feet beneath us, between masses of a highly feldspathic granite.

Down this cañon could be seen the distant peak of the San Antonio Mountain, while on its northern bank, and but a mile or two from us, rose jagged peaks to the height of 2,000 feet. On either bank of the Los Pinos River was a range of high mountains showing ledges of volcanic and metamorphic rock; these mountains were covered with a heavy growth of pine, spruce, and aspen timber, which in many places had been killed by forest fires, and their blackened trunks either stood tall and dark against the horizon, or in a fallen position helped form (with the thrifty undergrowth of aspen) an impenetrable entanglement.

The valley of the Los Pinos and the valleys of all its tributaries were covered with a most luxurious growth of bunch-grass, which at this season of the year would support large herds of stock, but the immense snow-fields still remaining in the ravines bespeak a severe winter.

From Camp No. 15 we crossed a level space more than half a mile in width, and there commenced the descent of a long and somewhat steep hill, at the bottom of which ran a small but very rapid stream; this passed, we found ourselves confronted by a high "hog-back," which it was necessary to cross, and the ascent and descent of which were both very difficult; from the foot of the descent we carried the line over the hill again, and up the north bank of the creek. In making a reconnaissance later in the evening, in company with Mr. Anstey, I discovered that a better road could be made by following down this second small stream to near its mouth, and there crossing it; the road should cross the main creek near this point, and follow up its south bank, which is throughout less steep than the northern one.

After leaving Camp 16, we followed the Los Pinos about a mile, and crossed it. We then followed one of its tributaries to its source, which was on the Chama divide.

Where we crossed the Los Pinos it is a stream 3½ feet deep and about 50 feet wide, with a very swift current. It was probably at its highest stage when we saw it, as the snow still lay almost in mass about its headwaters.

Our camp, No. 17, was near a beautiful little lake about an acre in extent, almost hidden by immense pine trees, and surrounded by high snow-banks. On account of our altitude the nights were becoming very cool, and on the 19th day of June we found a thick crust of ice on our

water-bucket at sunrise. The snow-banks, which had given us trouble as we were coming into camp, were so frozen as to allow our train to pass without difficulty next day.

I made a long detour on horseback, to the north of the line between Camps Nos. 16 and 17, to see if a practicable route could not be opened in that direction which would avoid the difficult hills we had met the day previous; but I found the country of the same rugged character as that we had passed, and it became more abrupt and snow-bound the farther north I proceeded. I am satisfied that no practicable road can be made to the north side of our line, as it was with great difficulty that I was enabled to get my horse over it, and for a greater part of the way I was forced to dismount and lead him.

The divide at Camp 17 was very low on the side of the Los Pinos, but the descent to the Chama was quite abrupt. At this point the valley of the Chama is at least two miles wide, and supports a more luxuriant vegetation than any we had yet seen. For about three miles from the point at which we entered it we found very heavy timber, some of the pines measuring more than four feet in diameter, and 200 in height. Below this the valley is open and thickly covered with a heavy growth of bunch-grass. Wild flowers were found in great profusion and beauty. The valley is inclosed on the north by a range of knife-edge hills, back of which this branch of the Chama rises. Their southern faces are composed of a soft, white, disintegrated material, probably lime or feldspar. At the foot of the highest peak is a beautiful little park of about 50 acres extent, containing a small lake of clear water. The south bank rises gradually into the high Chama Mountains, which are timbered to their summits with heavy pines.

About four miles from Camp 18 we crossed the river, but only with considerable difficulty. The banks are about 50 feet high, and very steep, and the stream very rapid. A short distance below this point the Chama receives a large tributary from the west, up the valley of which the snow-covered Navajoe range is visible. The remainder of the valley between this point and our Camp 21, at Los Ojos, is very much like that part of it we had already passed, except that the west bank assumed a mesa-like appearance, and heavy timber, with an undergrowth of scrub-oak, continues down the mountain to the river's edge. Several small streams, running through deep and narrow ravines, must be crossed, but there is an abundance of material at hand, with which they may easily be bridged. The west bank of the river is close under the mesa-wall, and offers no site for a road.

The Tierra Amarilla includes five Mexican plazas, named Hutritas, Ensenada, Los Ojos, Los Brazos, and La Puenta. The general name is borne by a section of country near old Fort Lowell, which, under irrigation, produces fair crops of corn and cereals, but stock-raising is the principal industry of the inhabitants. Near the plaza Los Brazos the Chama is formed by what are known as the east and west branches, the former of which rises about a mile south of our Camp 17, and debouches from the Chama range through a very precipitous cañon. The river here is about 80 feet wide, with an average depth of 3 feet, and a very swift current, making the fords at this season of the year very difficult. In ordinary stages of water they offer no obstacle to an easy passage of trains.

From Pierra Amarilla we missed our direction, and ran our line for the first day along the Santa Fé road to the crossing of the Nutrias; to the east of the road runs a high sandstone and conglomerate cliff, forming a divide between the Nutrias and the Nutritas creeks; to the east

is a series of low hills, covered with pine, piñon, and cedar, between which stretch broad plains, producing a heavy growth of sage-brush. Farther up on the side of the mountain are immense fields of scrub-oak and aspen.

From Camp 21 we descended the Nutrias, whose valley for the most part contains indifferent grazing, but very thrifty sage-bush.

The whole of the valley, as far as Camp 22, is composed of a loose drift; here the stream enters a box cañon with soft sandstone walls, the stratification of which is nearly horizontal.

Two routes here presented themselves, the one crossing the Chama about a mile below the mouth of the Nutrias, and the other about three miles above it. Owing to the apparent impracticability of the lower ford, I concluded to cross at the upper one, and accordingly ordered my party to take that direction, and, after crossing, to follow down the valley to the west of the Gallinas Mountains, while I rode on to Fort Wingate to obtain rations and supplies necessary for my escort. I met with some difficulty in getting down the river through a system of narrow and intricate cañons, and when on its banks found it no easy matter to pass the stream in its then high stage.

I did not anticipate that there would be any difficulty in crossing the pack-train at the regular ford, but on my return to the party I learned that one animal had been swept away by the current and only saved with extreme risk to the men, and that two days had been spent in the passage. The river was 3½ feet deep, with rocky or gravelly bottom, but at the ford the gravel gave way and developed a dangerous quicksand underneath. It is probable, however, that this was in some way due to the high state of the water, as teams have passed here without difficulty for years.

While packing the train previous to leaving the camp on the west bank of the Chama, Private John Dougherty, F Company, Third Infantry, was instantly killed by the accidental discharge of a carbine, which had carelessly been left loaded after a hunt the previous evening. He was buried on the west bank of the Chama, at the foot of a high mesa near the lower crossing; his grave was piled with stones to protect it from the wild animals, and its head marked by a rude cross.

After leaving the Chama we passed down a trail made by Major Price, Eighth Cavalry, in the summer of 1872. The road at first ascends an arroya, skirting the base of the Gallinas Mountains; then rises a low divide some ten miles distant from the lower ford. The country near the river is furrowed by numerous deep gullies, and produces little else but sage-brush and cactus. At the divide we entered a valley some thirty-five miles in length and from three to twelve miles in width. This valley is bordered on the east by a range of mounts, through which two small streams, the Gallinas and the Copulin, find their way to the Chama. The north end of the range is called Gallinas, the middle section Copulin, and the south end Jemez. They are all covered with evergreens and aspens to their summits, and their more abrupt faces show strata of various-colored sandstone. Near the plaza of Nacimiento the Jemez Mountains sent far into the valley spurs of low hills, covered with heavy pine and spruce timber. Between these hills are grass-grown meadows, traversed by clear mountain streams, bordered with willows. The first of these streams is the Puerco, which, after reaching the main valley, turns to the south and receives the others as tributaries.

The west of this valley is shut in by a range of sandstone mesas from 100 to 500 feet high, showing, in their vertical sides, shales, conglomerates, clays, and various colored strata of friable sandstone. This forma-

tion extends down the west bank of the Chama to old Fort Lowell, from a point some twenty miles above it; near that fort it leaves the river and follows down to the west of the Puerco as far as the stage-road crossing, where it apparently ends. Its southern face is seen to the north of the road over its whole length to Fort Wingate. This valley is traversed, longitudinally, from its northern extremity to the head of the Puerco by one principal range, a number of smaller ranges of knife-edge hills of peculiar appearance, sometimes rising to a height of 300 feet. They are formed of a soft, light-gray sandstone, with strata having a dip to westward of near 45°.

The west face has a thin covering of soil supporting a growth of evergreens; the east face is nearly vertical, showing the edges of the strata; the bottom is filled with *débris*.

These ranges are in several places broken through by streams which take their rise at the foot of the mesas on the west, and find their way to the Chama. At the time of our passage they were dry, and to all appearances their principal use was to carry off surface-water. The remainder of the valley is gently rolling. The lower hills are covered with evergreens, and the level spaces between them with a rank growth of sage-brush. The flies were so numerous about these small creeks that we were obliged to go into camp nearly a mile from water, and send down our kegs for a night's supply. Many pieces of both painted and unpainted pottery and some stone arrow-heads were found on mounds of drift, among fragments of quartz and petrified wood, but none were to be seen on the higher hills, nor were they to be found in any numbers on the level plain. Near Nacimiento were several large meadows, supporting fine herds of stock; but little of the ground was under cultivation.

I left my party at the crossing of the Chama on June 25, and reached the mail station on the Puerco, distant near 100 miles, next day at 11 a. m. I here took the buck-board and rode to Fort Wingate, where I remained two days, and drew supplies for my escort. I took my supplies with me as far as the Puerco on the buck-board. Here a pack-mule was in waiting to carry them to camp, which was then near the head of the Puerco, some thirty-five or forty miles distant. I reached my camp on July 1, and next day retraced my steps toward Tierra Amarilla, which place was arrived at by my party on July 4. From this point I desired to make a horse-back reconnaissance of a trail leading to Conejos, by way of the east fork of the Chama, but my own horse was too much exhausted to undertake the journey, and I was unable to procure a fresh one. I learned, however, from reliable sources that the trail passing this way, though direct and easily passable for animals, could not be made into a wagon-road on account of the numerous steep hills it crosses and the many rocky ledges over which it leads.

On July 5 we commenced our second line, which connects with our first near the plaza of Las Nutritas, and ran it up the Nutritas about six miles. This stream we found timbered with evergreens for about five miles, when it opens out into a broad expanse covered with scrub-oak. This plane is terminated on the south by an abrupt cliff, disclosing a few badly-preserved cretaceous fossils. The summit of this cliff is the divide between the Nutrias and the Nutritas, and from its highest points a most magnificent view of both valleys and the mesas beyond the Chama is obtained. We found the ascent of the Nutrias gradual and easy, and met with no difficulty until we neared its source, where we entered a heavy forest of pine and aspen, which furnished a serious obstacle to the running of our line.

Camp No. 32 was made on the summit of the Chama rang·, at the foot of a very high conical peak, composed mostly of lava, trachyte, and pumice. Many beautiful varieties of flowers, among them the columbine, wild tulip, and a brilliant yellow lily, were found here growing at the very edge of the not yet melted snow-banks. Our course now lay down the Vallacita some five or six miles, between ranges of low pine-clad hills. This valley is in some places narrow and closed by heavy timber, but through most of its length is open and covered with rank grasses. We left the main stream at a point where it receives a tributary from the north and another from the east, and turns directly to the south through a rocky gorge. The line here passes over a point of metamorphic rock and ascends the narrow ravine of the eastward branch to an open meadow near its source. This meadow is surrounded by low hills covered with pines and aspens, in the shadows of which banks of snow were still remaining. The small stream which takes its rise here alternately expands into pools several yards wide and contracts to the merest thread of a channel, almost concealed by its grassy banks, meanwhile retaining a depth of a couple of feet or more, and disclosing through its crystal waters a sparkling schistose bottom. The whole region about the headwaters of the Vallicita is broken by bold outcroppings of schistose rock and highly feldspathic granite. After leaving camp 33, we descended a branch of what is known at its source as Las Tusas Creek, but what is known farther down as Petaca. The first mile of our descent was rendered difficult by a dense undergrowth of aspens, and by the marshy condition of the ground, occasioned by the melting snow-banks, the last of which in our course we here passed. Below this thicket the valley opens out into a most fertile pasturage, bordered by timbered hills. The clear stream traversing it is filled with brook-trout. In the evening a large cinnamon bear passed by our camp and entered the woods near it, where he was unsuccessfully pursued by a party of my men.

From Camp 34 we ascended a small branch of the Petaca for about a mile, and then passed over a low divide in an easterly direction to a second branch, which we followed to its source. All this country is gently rolling, and its valleys furnish good grazing to numerous sheep-herds. The highest parts are well timbered with pine, spruce, and cedar, and the banks of the small streams are lined with willows.

To the west of us rose the high snow-crowned mountains we had just crossed, while in our front appeared a mesa towering some 3,000 feet above us. An occasional face of sandstone with horizontal stratification was seen, but most of the country is covered with small bowlders of dark, vesicular lava. This formation extends as far as Camp 35, near the headwaters of a small branch of the San Antonio, called Nutritas Creek. The high plain between the Nutritas and the cañon at the head of the Petaca is about four miles in length by three in width, and is dotted with small patches of heavy timber. It is inclosed by the lofty mesa on the east and the still higher mountains on the west, and affords good pasturage to large stock-herds.

The Petaca Cañon, through which we passed, is nearly one-half mile in length and from 20 to 150 feet deep. It is very narrow and its bottom is strewn with lava bowlders.

Near the Nutrias we entered an arroya grown with huge pines; this we followed down to the creek, where we made camp in a valley beautifully supplied with fine grass. Next day we followed this creek down about four miles to its mouth, and ascended a steep hill leading to another volcanic mesa, supporting an occasional pine and but little

grass. At the foot of this mesa, on the east, lay the plaza of San Antonio, on the creek of the same name. Here I was obliged to employ a wagon to convey to Fort Garland one of the members of my escort, who had been very ill for several days with dysentery. At Los Pinos we again entered a level and cultivated country; cottonwood trees lined the creek, giving its valley, as seen from the mesa above, an appearance of thrift.

On July 12 we finished our line at the point of beginning, and made camp on the San Antonio River, near its junction with the Conejos. The valley here is very low, and in many places was still wet and boggy. On our arrival here, a month previous, it was entirely submerged. Our route now continued along the Conejos to its mouth. For a greater part of its length, this stream flows through several channels, forming a great number of small islands, most of which are covered with good grass and thrifty cottonwoods. Beyond these islands the country does not differ from the remainder of the San Luis desert in any respect.

In the angle formed by the Conejos and the Rio Grande runs a broken range of abrupt hills and mesas, terminating on the south in the San Antonio Mountain, which is an immense conical peak, rising some 3,500 feet above the general level of the country. It was along this route, and but a few miles from the Rio Grande, that Lieutenant Pike was captured by the Mexicans in the early part of the present century, and taken to Mexico.

Owing to our having taken a wrong road, the Rio Grande was reached at a point some three miles above the ford. Here the meadows on its banks were covered with large pools of water, on which floated hundreds of young ducks and water-fowl; the mosquitoes were so numerous as to be hardly bearable, and gave us more annoyance than they had given us at any previous time on our journey.

The Rio Grande was much lower than when we crossed it before, but still was not down to its summer level. We lightened the packs on our animals and crossed in a very short time without accident, although the water nearly covered the backs of the smaller mules. We followed the valley of the Princhera direct to Fort Garland, where we arrived on July 15. I at once turned over my quartermaster's property, and made application for transportation to Fort Lyon. Next day I was furnished a wagon in which I dispatched my escort, but I was obliged to remain over another day before an ambulance could be placed at my disposal. This same evening I received a copy of a telegram from the assistant adjutant-general Department of Missouri, directing me to return my assistants to Fort Leavenworth at once. I left Fort Garland on July 17, and traveled by the Sangre de Cristo Pass and the Huerfano and Arkansas Valleys to Fort Lyon, which point I reached on the 20th.

I here disbanded my party, the members of the escort returning to their companies, and my assistants to Fort Leavenworth, as directed. In obedience to a telegraphic order of the 21st instant, I left Fort Lyon on the 23d, and arrived on the 24th.

COMPARISON OF ROUTES.

Between Fort Garland and Conejos two routes present themselves; the one by Culebra and Meyer's Ferry is about ten miles the longer, and has a very sandy stretch of eight or ten miles, over which travel will be tedious and difficult. This route presents the further objection of not being so well supplied with wood and grass.

In the one case the Conejos, and in the other the San Antonio, must be passed, and to insure a crossing at all seasons of the year a bridge would be necessary over either. There was a bridge over the Conejos at Guadaloupe, but last spring's freshets carried it away; several of the most responsible citizens of the place informed me that it would in all probability be rebuilt.

The Rio Grande is unfordable for about two months of each year, and there is but little choice in this respect between the two fords. If the river is to be bridged, it may as easily be done at the one place as at the other. The road by way of the Trinchera is hard and level, and in every respect a good passage-way.

From Guadaloupe, by our first line, the road is a good one as long as it remains in the valley of the Conejos; after leaving this valley it rises a hill, on which some work will be required for nearly a mile. The principal labor will consist in removing the surface-stones and leveling the side-slopes. This, I think, can be accomplished by 150 days' work. Some timber would have to be cut on the top of the hill, and a little grading done on the descent, but a few days' labor will complete it all. The crossing of the creek near Camp 14 would be materially improved by a small bridge, which might be readily constructed from timber found on the spot. Beyond this point the way must be cleared for about two miles, of fallen timber and underbrush, for which I would estimate 200 days' work. The next difficulty is between Camps 15 and 16, where the route is at first level and marshy, and afterward passes over a steep hill. I presume the marshy places would give little or no trouble after they had been passed over a few times by wagons, as the paths were more firm than the untrodden ground.

The descent of the first hill could be made without much difficulty by properly winding the road to take advantage of the lightest grades. A bridge at its foot will be necessary for an easy crossing of the creek. The passage of the hill beyond this point can only be made good by continuous grading for nearly a mile; this will require 500 or 600 days' work. The hill is very steep on both slopes, and in some places will give a grade of at least 1 foot in 8. At the bottom of its western slope, about 300 yards of road must be made of stone, along one wall of a narrow gorge, and then carried across a small creek by a bridge; there is at hand, however, plenty of stone and timber for all needs.

Some little siding will require to be made between this point and the head of the Chama, and a bridge or ford must be made across the Los Pinos, and several small bridges across its tributaries; 600 days' work will probably complete this portion of the road.

The descent to the head of the Chama and the passage of the stream at the foot of the hill are the next difficulties to be encountered, except such as may be given by snow. On June 20 there were still large snow-banks on this divide, but none that would obstruct travel on a properly-defined road. The hill here can be passed by careful grading at about one on nine, and the stream may be easily bridged. The side-hill along which our line next passes is broken by high knolls and deep ravines, most of which may be in great part avoided; some work, however, must be done here in the way of grading, and a number of large trees must be cut. The exact amount of work to be done can only be determined after the road receives a definite location.

A bridge must be built over the Chama, at the crossing below Camp 18, and some work will be required on its steep banks. Between here and the plaza of Las Nutritas, about one-half mile of siding must be

made, and some three or four small bridges built over narrow ravines. For a short distance, the way is obstructed with timber, but no difficulty will be experienced in removing it.

In going from Tierra Amarilla to Fort Wingate, three crossings of the Chama are to be chosen between; the upper one is the plaza of La Puenta, and has recently been washed out at the side, so as to be entirely impassable. The next one in order is about eight miles farther down the stream, and gave us great trouble on our outward trip by its treacherous bottom. The third is about four miles farther still below, and is difficult to reach on account of high bluffs on both sides the stream. I think the middle one will give the best crossing and the most direct road.

The remainder of the route to Fort Wingate has recently been traveled by wagons, and is, without any work, a very good road.

On our return from Tierra Amarilla to Conejos, we found a good route up the Nutritas to near its head, where one-half mile of grading must be done, and on the first divide timber must be cleared for nearly a mile. In the valley of the Vallicita, a few days' work will be necessary on side-hills and at the creek-crossings.

In passing from the Vallicita to the Patoca a narrow cañon is met, up which a road must be constructed of stone, or a detour must be made over a steep hill requiring deep side-cutting. Plenty of material is convenient for the making of this part of the road.

At the head of the Patoca a narrow ravine, filled with a dense growth of small aspens, is met with, and to construct a good passage-way through it will require two hundred days' work or, perhaps, more. The country is open the balance of the way, except for a short distance in a narrow cañon ascending from the Patoca, where a rocky bottom will give some trouble. A good road can be made, however, up either one of two branches, a choice between which must be made after a careful inspection of both.

The descent to the San Antonio only requires the removal of a few fallen trees and the making of a few yards of grade. In rising from the San Antonio to the high mesa, which ends at Los Pinos, a steep hill is met with, up which a grade of 1 in 8 can be obtained. The descent near the plaza of Los Pinos is about 1 in 6, but is not more than one hundred yards in length. From here to the plaza of Guadalupe the road is good, level, and direct.

RECOMMENDATION.

From Fort Garland to Conejos, I would recommend the road by way of the Trinchera as being the most direct and in every way the best one. From Conejos to Tierra Amarilla, the second route, the one run on our return, is preferable, in that it is less liable to be closed in winter by snow, and it can be made with easier grades and at less expense. Both routes are supplied with wood, water, and grass in the greatest abundance. The distance by the two lines is about the same, unless the second one be turned down the valley of the Nutrias to the middle ford, in which case it would be a few miles the shorter. Materials for bridges exist in abundance at all points where their use is desirable, except on the Rio Grande, where timber must be carted about twenty miles.

If the road be made by the labor of troops, I think a full company can complete it from Fort Garland to the mail-station on the Puerco in three months. This estimate does not include the building of a bridge over

the Rio Grande at the Trinchera, or over either the Conejos, Los Pinos, or Chama. The three latter bridges can be made without great expense.

All of which is respectfully submitted,

GEO. S. ANDERSON,

Second Lieutenant, Sixth Cavalry, in charge of Survey.

Lieut. E. H. RUFFNER, *United States Engineers,*
Chief Engineer Department of the Missouri,
Fort Leavenworth, Kans.

GENERAL TABLE.—*Survey for direct route from Fort Garland, Colo., to Fort Wingate, N. Mex.*

Date.	Stadia distance from Conejos.	Stadia distance from last camp.	Number.	Names.	Latitude.			Longitude.			Soil.	Timber.	Grass.	Water.
1874.					°	′	″	°	′	″				
June 14	.....	.....	.....	Initial point 13 chains west of ¼ sec. corner between secs. 19 and 20, T. 33 N., R. 9 E., of the N. N. E. principal meridian.	37	04	45.154	105	51	52.134	.....	.....	.....	
14	2.400	.....	.....	Plaza San Rafael	.....	.....	.....	.....	.....	.....	Near the river the soil is irrigated and cultivated.	Cottonwood along the river; piñon and pine on the bluffs.	.....	
14	6.388	.....	13	Camp on the Rio Conejos.	37	02	27.058	105	58	07.314	Dry and sandy on the upland.	.....	Fair	Good.
15	12.805	6.417	14	.....	37	01	58.077	106	04	28.871	Good	Pine, spruce, aspen, a few cedars; willow and cottonwood in the valley.	Good	Do.
16	17.273	4.468	15	.....	37	00	59.375	106	08	18.961	....do	.....do	Very good	Do.
17	21.633	4.360	16	Camp on the Rio Los Pinos.	36	59	51.095	106	12	20.531	....do	Pine, spruce, and aspen	Good	Do.
18	25.833	4.200	17	On divide at head of the Rio Los Pinos.	37	00	37.601	106	16	40.471	....do	.....do	....do	Do.
19	30.496	6.663	18	On the Rio Chama	36	58	32.496	106	20	18.031	....do	Pine, spruce, aspen, willow, and scrub-oak.	Very good	Do.
20	38.441	7.945	19	.....	36	53	01.517	106	24	42.441	....do	Pine, spruce, aspen, willow, and scrub-oak; very fine timber.	....do	Do.
21	47.841	9.400	.....	Los Brazos	.....	.....	.....	.....	.....	.....	.....	.....	.....	
22	49.941	11.500	.....	Los Ojos	.....	.....	.....	.....	.....	.....	Soil fair; irrigated in some places.	Pine, scrub-oak, cottonwood, aspen, and willow. The pines are very fine.	....do	Do.
22	50.377	11.936	20	Camp near Los Ojos, Tierra Amarilla.	36	43	22.773	106	24	50.463	.....	.....	Land near camp is mostly cultivated.	Do.
23	51.184	0.807	.....	Station No. 248, (point of departure on return route.)	36	42	46.316	106	24	48.591	.....	.....	.....	
23	62.200	11.016	21	Camp on La Nutrias Creek.	36	36	19.233	106	21	36.230	Soil dry and sandy; fair on the banks of La Nutrias Creek.	Pine, piñon, cedar, and scrub-oaks; willow at the camp.	A little grass among the sage-bushes.	Fair.

24	72.165	9.965	22	On La Natrias Creek, at entrance of cañon.	36	35	17.435	106	31	88.314	Indifferent	Sage-brush, pilon, and cedar on the bluffs; willow and box-elder on the banks of the creek.	Poor grazing	Good.
25, 27	76.279	4.114	24, 26	At the lower ford of the Chama.	36	33	42.610	106	34	44.161	do	Pilon, cedar, and spruce	do	Note.
July 2, 3	92.301	16.022	27	Camp near Fly Creek.	36	23	16.632	106	41	58.507	Fair	Pine, cedar, pilon, sage-brush.	Good	Very poor.
June 29	101.789	9.488	25	Camp at Marshy Pond	36	16	02.472	106	46	00.622	do	do	Indifferent	Do.

GENERAL TABLE.—*Survey for direct route from Fort Garland, Colo., to Fort Wingate, N. Mex.*

Date.	Stadia distance from Station No. 248.	Stadia distance from last camp.	Number.	Names.	Latitude.			Longitude.			Soil.	Timber.	Grass.	Water.
					°	′	″	°	′	″				
1874.														
July 4				Station No. 248	36	42	46.316	106	24	48.591				
4	1.300		29	Near Plaza La Nutrita	36	42	04.626	106	23	40.990	Good, (irrigated)	Pine, spruce, and willow	Good, but close cropped by cattle.	Good.
5	1.650	0.350		Plaza La Nutrita									Good	Good.
5	7.121	6.821	30	La Nutrita Creek	36	38	29.813	106	20	14.567	Good	Pine, aspen, scrub-oak, cottonwood, and willow.		
													do	Do.
6	11.002	3.881	31		36	38	02.347	106	16	42.534	do	do	do	Do.
7	15.887	4.885	32	Near the divide	36	38	21.814	106	11	51.860	do	Pine, aspen, willow, and scrub-oak.	do	Do.
8	24.907	8.320	33		36	42	27.894	106	05	19.759	do	Pine, spruce, aspen, and willow.	do	Do.
9	28.276	5.069	34	Station No. 141, Las Tuses Creek.	36	43	47.052	106	01	49.281	do	do	do	Do.
10	34.835	6.559	35	On La Nutrita Creek	36	48	49.899	106	02	34.856	do	do	do	Do.
11	48.259	13.424	36	On Los Pinos Creek	36	58	36.509	105	55	04.901	Arid	Spruce, pine, aspen, cottonwood, and willow.	Poor	Do.
12	55.641	7.382		Initial point of survey	37	04	17.919	105	52	58.804	do	Cottonwood and willow along the banks of the creek.	do	Do.